

Dataset Expocode **33GG20121108**

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Dataset **Funding Info:** NOAA Climate Program Office; NOAA Ocean Acidification Program
Initial Submission (yyyymmdd): 20160329
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Campaign/Cruise **Expocode:** 33GG20121108
Campaign/Cruise Name: GU1204_Leg2
Campaign/Cruise Info: AOML_SOOP_CO2
Platform Type:
CO2 Instrument Type: Equilibrator-IR or CRDS or GC
Survey Type: Research Cruise
Vessel Name: R/V Gordon Gunter
Vessel Owner: NOAA
Vessel Code: 33GG

Coverage **Start Date (yyyymmdd):** 20121109
End Date (yyyymmdd): 20121120
Westernmost Longitude: 88.6 W
Easternmost Longitude: 83.2 W
Northernmost Latitude: 30.2 N
Southernmost Latitude: 24.9 N
Port of Call: Pascagoula, MS

Variable **Name:** xCO2_EQU_ppm
Unit: ppm
Description: Mole fraction of CO2 in the equilibrator headspace (dry) at equilibrator temperature (ppm)

Variable **Name:** xCO2_ATM_ppm
Unit: ppm
Description: Mole fraction of CO2 measured in dry outside air (ppm)

Variable **Name:** xCO2_ATM_interpolated_ppm
Unit: ppm
Description: Mole fraction of CO2 in outside air associated with each water analysis. These values are interpolated between the bracketing averaged good xCO2_ATM analyses (ppm)

Variable **Name:** PRES_EQU_hPa

Unit: hPa
Description: Barometric pressure in the equilibrator headspace (hPa)

Variable **Name:** PRES_ATM@SSP_hPa
Unit: hPa
Description: Barometric pressure measured outside, corrected to sea level (hPa)

Variable **Name:** TEMP_EQU_C
Unit: Degree C
Description: Water temperature in equilibrator (°C)

Variable **Name:** SST_C
Unit: Degree C
Description: Sea surface temperature (°C)

Variable **Name:** SAL_permil
Unit: ppt
Description: Sea surface salinity on Practical Salinity Scale (o/oo)

Variable **Name:** fCO2_SW@SST_uatm
Unit: μ atm
Description: Fugacity of CO₂ in sea water at SST and 100% humidity (μ atm)

Variable **Name:** fCO2_ATM_interpolated_uatm
Unit: μ atm
Description: Fugacity of CO₂ in air corresponding to the interpolated xCO₂ at SST and 100% humidity (μ atm)

Variable **Name:** dfCO2_uatm
Unit: μ atm
Description: Sea water fCO₂ minus interpolated air fCO₂ (μ atm)

Variable **Name:** WOCE_QC_FLAG
Unit: None
Description: Quality control flag for fCO₂ values (2=good, 3=questionable)

Variable **Name:** QC_SUBFLAG
Unit: None
Description: Quality control subflag for fCO₂ values, provides explanation when QC flag=3

Sea Surface Temperature **Location:** hull mounted, ~3 m below sea surface
Manufacturer: Furuno
Model: T2000
Accuracy: 0.2 (°C if units not given)
Precision: 0.1 (°C if units not given)
Calibration: Factory calibration
Comments: Manufacturer's Resolution is taken as Precision; Maintained by ship.

Sea Surface Salinity **Location:** In Chem lab, next to CO₂ system
Manufacturer: Seabird
Model: SBE 21
Accuracy: \pm 0.05 o/oo
Precision: 0.002 o/oo
Calibration: Factory calibration
Comments: Manufacturer's Resolution is taken as Precision; Maintained by ship.

Atmospheric Pressure **Location:** Next to the bridge, ~15 m above the sea surface water
Normalized to Sea Level: yes

Manufacturer: RMYoung
Model: 61201
Accuracy: ± 0.5 hPa (hPa if units not given)
Precision: 0.01 hPa (hPa if units not given)
Calibration: Factory calibration
Comments: Manufacturer's Resolution is taken as Precision; Maintained by ship.

Atmospheric CO2

Measured/Frequency: Yes, 5 readings in a group every 3 hours
Intake Location: Bow mast, ~18 meters above sea surface
Drying Method: Gas stream passes through a thermoelectric condenser (~5 °C) and then through a Perma Pure (Nafion) dryer before reaching the analyzer (90% dry).
Atmospheric CO2 Accuracy: ± 0.5 μ atm in fCO2_ATM
Atmospheric CO2 Precision: ± 0.01 μ atm in fCO2_ATM

Aqueous CO2 Equilibrator Design

System Manufacturer:
Intake Depth: 5 meters
Intake Location: Bow
Equilibration Type: Spray head above dynamic pool, no thermal jacket
Equilibrator Volume (L): 0.95 L (0.4 L water, 0.55 L headspace)
Headspace Gas Flow Rate (ml/min): 70 - 150 ml/min
Equilibrator Water Flow Rate (L/min): 1.5 - 2.0 L/min
Equilibrator Vented: Yes
Equilibration Comments: Primary equilibrator is vented through a secondary equilibrator.
Drying Method: Gas stream passes through a thermoelectric condenser (~5 °C) and then through a Perma Pure (Nafion) dryer before reaching the analyzer (90% dry).

Aqueous CO2 Sensor Details

Measurement Method: IR
Method details: details of CO2 sensing (not required)
Manufacturer: LI-COR
Model: 7000
Measured CO2 Values: xco2(dry)
Measurement Frequency: Every 140 seconds, except during calibration
Aqueous CO2 Accuracy: ± 2 μ atm in fCO2_SW
Aqueous CO2 Precision: ± 0.01 μ atm in fCO2_SW
Sensor Calibrations:
Calibration of Calibration Gases: The analyzer is calibrated every 3 hours with field standards that in turn were calibrated with primary standards that are directly traceable to the WMO scale. The zero gas is ultra-high purity air.
Number Non-Zero Gas Standards: 3
Calibration Gases:

Std 1: LL100000, 0.00 ppm, owned by AOML, used every ~3.0 hours.
Std 2: JA02267, 247.72 ppm, owned by AOML, used every ~3.0 hours.
Std 3: JB03296, 382.61 ppm, owned by AOML, used every ~3.0 hours.
Std 4: JA02689, 520.79 ppm, owned by AOML, used every ~3.0 hours.

Comparison to Other CO2 Analyses:

Comments:

Method Reference:

Pierrot, D., C. Neil, K. Sullivan, R. Castle, R. Wanninkhof, H. Lueger, T. Johannessen, A. Olsen, R. A. Feely, and C. E. Cosca (2009), Recommendations

for autonomous underway pCO₂ measuring systems and data reduction routines, Deep-Sea Res II, 56, 512-522.

**Equilibrator
Temperature Sensor**

Location: Inserted into equilibrator ~5 cm below water level

Manufacturer: Hart

Model: 1521

Accuracy: 0.025 (°C if units not given)

Precision: 0.001 (°C if units not given)

Calibration: Factory calibration

Comments: Resolution is taken as Precision.

**Equilibrator
Pressure Sensor**

Location: Attached to equilibrator headspace. Combined with Licor Pressure

Manufacturer: Licor

Model: None

Accuracy: 1.2 (hPa if units not given)

Precision: 0.02 (hPa if units not given)

Calibration: Factory calibration

Comments: Differential pressure reading from Setra-239 attached to the equilibrator headspace was added to the pressure reading from the LICOR analyzer to yield equilibrator pressure. Manufacturer's Resolution is taken as Precision.

**Additional
Information**

Suggested QC flag from Data Provider: NA

Additional Comments: On YDay ~320, the licor misbehaved and drifted down substantially, making H₂O and CO₂ values go down. After xCO₂ corrections using standards, values looked very reasonable. Still, xCO₂ values have been flagged 3 - other see metadata. At the end, all data were flagged 3 - questionable SST because of the Furuno T2000 resolution of 0.1 °C. All original data can be found at: http://www.aoml.noaa.gov/ocd/ocdweb/gunter/gunter_introduction.html

Citation for this Dataset:

Other References for this Dataset: